1350.0 - Australian Economic Indicators, Aug 1999

ARCHIVED ISSUE Released at 11:30 AM (CANBERRA TIME) 30/07/1999

Feature Article - Upgrade of Capital Stock and Multifactor Productivity Estimates

The following article is reprinted from **Australian System of National Accounts 1997-98** (ASNA 1997-98) (ABS Cat. no. 5204.0). ASNA 1997-98, released in April 1999, presents Australia's annual national accounts and includes estimates of capital stock and productivity. A selection of these estimates is provided as an appendix to this article (see table A1 Indexes of productivity and related measures (pg 15) and table A2 Capital stock (pg 16)). Australian Economic Indicators plans to publish further analysis of capital stock and productivity estimates in forthcoming issues.

INTRODUCTION

During the past year, the Australian Bureau of Statistics (ABS) has been redeveloping its capital stock and multifactor productivity (MFP) estimates. The new estimates are included in Australian System of National Accounts , 1997-98 (ABS Cat. no. 5204.0) (released April 1999). Major changes include a switch from constant price estimates to chain volume measures, the weighting of the components of capital stock at a more detailed level, the expansion of the capital asset boundary, and the full integration of capital stock and MFP estimates. The ABS is firmly of the view that the upgraded capital stock and MFP estimates are significantly better than those previously published. Nonetheless, the estimates, particularly those for capital services and MFP, are very sensitive to the assumptions that underlie them. For this reason, it has been decided to label the new estimates of capital services and MFP as ‘experimental’, pending a user review of the methodologies. To this end, the ABS would welcome feedback from users on any aspects of the methodologies.

CAPITAL STOCK ESTIMATES

Capital stock estimates provide information about the stock of capital available in an economy at a particular point in time. Three measures of capital stocks can be distinguished - gross, net and productive.

The value of an economy’s gross capital stock is obtained by valuing each asset in use at the current price of a new asset of the same type, regardless of the age of the asset; Net (or economic) capital stock estimates are the written down values of an economy’s gross capital stocks. They represent the net present values of the future capital services to be provided by the assets. The difference between the net and gross value for an asset is accumulated depreciation. Net capital stock is essentially a measure of wealth and is shown in an economy’s balance sheet;

Productive capital stock estimates are derived by writing down each asset in accordance with its decline in efficiency due to age. If, for example, an asset is 75% as efficient as a new asset of the same type, then the productive value of that asset is 75% of the value of the new asset. Efficiency tends to decline with age, as older assets require more frequent and extensive

maintenance and more replacement parts, or become less useful due to increasing obsolescence. Productive capital stock estimates are a measure of productive capacity and they form the basis for the measure of capital services required for productivity analyses;

Two flow concepts are relevant to capital stocks - consumption of fixed capital and capital services;

- **Consumption of fixed capital** (or economic depreciation) represents the value of a capital asset that is ‘used up’ in a particular period. The real consumption of fixed capital of an asset in a period is the difference between the real economic value of the asset at the beginning of the period and at the end of the period; and

- **Capital services** reflect the amount of ‘service’ each asset provides during a period. For each asset, the services provided in a period are directly proportional to the asset’s productive capital value in the period. As an asset ages and its efficiency declines so does the productive capital value and the services the asset provides. The value of capital services is equal to the gross returns (or rentals) to owners of capital which are the sum of economic depreciation during the period and a rate of return on the net capital stocks of assets. The relationship between the rental on an asset and the asset’s productive value is fixed over the asset’s life. However, this relationship varies from asset to asset and it depends on an asset’s expected life, the discount rate, and the rate of decline in the asset’s efficiency.

Although the concepts of productive and economic capital are quite different they are intimately related: given the real productive capital stock and a suitable discount rate we can determine the real economic (i.e. net) capital stock and, after reflation, the current price economic capital stock. The age-efficiency function (after being multiplied by a suitable scalar) defines how the flow of real capital services from an asset declines over the asset’s life. Since the value of the flow of capital services in a period is equal to the rental, the real economic value of an asset at any time can be calculated - given a discount rate - as the sum of discounted future real flows of capital services. Once the real economic values of an asset are determined over its lifespan an age-price function can be derived.

CAPITAL STOCK MEASUREMENT

There are two broad approaches to the measurement of capital stock - direct measurement and the perpetual inventory method (PIM).

Direct measurement, as the name implies, involves direct approaches to businesses to obtain estimates of their capital stock. This approach is used by only a few countries.

Most countries, including Australia, use the PIM to derive capital stock estimates. The PIM is essentially a ‘rolling’ inventory of capital stocks; in any particular period investment in capital assets is added to stocks and retirements of assets are deducted. To construct a PIM, a number of underlying assumptions are required, including assumptions about:

- the average length of asset lives;

- the extent to which assets are retired before, on, or after the average asset life for that asset - the asset life distribution;

- the age-price function of assets (used to derive net capital stock estimates and estimates of consumption of fixed capital); and

- the age-efficiency function of assets (used to derive productive capital stock estimates).

PREVIOUS ABS ESTIMATES OF CAPITAL STOCKS

The constant price estimates of net capital stock for each sector were derived by accumulating constant price estimates of capital expenditures over time and making an allowance for the depreciation of the assets over the span of their productive lives or until they were sold to another sector. Current price estimates of gross and net capital stock were derived by inflating the constant price estimates.

In the past, separate estimates of gross and net capital stock were derived for

- various sectors of the economy - private and public financial and non-financial corporations, households (including unincorporated enterprises and non-profit institutions serving households) and general government; and
- four asset types - equipment, dwellings, non-dwelling construction and real estate transfer expenses.

Industry estimates were derived for the private and public enterprise sectors, and estimates for general government were derived by broad purpose category.

Crude estimates of productive capital stock were derived for equipment, non-dwelling construction and real estate transfer expenses by taking weighted averages of gross and net capital stock. A major problem with the previous capital stock estimates was that the relationship that should exist between productive and economic capital stocks did not exist. This was because the ABS did not derive productive capital stocks using age-efficiency functions that were consistent with the age-price functions underlying its net capital stocks.

The most important parameter in estimating capital stock using the PIM is the mean life of the assets. The ABS has never undertaken a comprehensive survey to obtain asset lives - indeed very few national statistical agencies have - and there is a paucity of good quality data world wide. The ABS, therefore, used detailed asset life schedules from the Australian Taxation Office. As it is known that these understate the economic lives of assets, they were calibrated by comparing weighted averages of them with the asset lives used by other OECD countries at an aggregate level.

The ABS assumed that the mean asset lives of dwellings, non-dwelling construction and real estate transfer expenses did not change over time, but the mean asset lives of equipment declined by 5% a decade.

The second most important assumption in using the PIM is the rate at which assets lose their value over the course of their lives. The ABS assumed that it is a constant amount - commonly referred to as straight line depreciation.

It seems reasonable to assume that assets of a particular type are not all retired at the same age. The ABS assumed that they retired according to a Winfrey distribution function (a bell-shaped curve) about the mean asset life.

CHANGES MADE AS THE RESULT OF INTRODUCING SNA93

The implementation of SNA93 has had three major implications for the ABS's capital stock estimates. First, the asset boundary has been expanded to include:

- government expenditures on defence assets that could be used for civilian purposes;
- livestock - farm animals used for breeding and recurrent production (only sheep and cattle are included for the time being); and
- intangible fixed assets, comprising computer software, mineral exploration and artistic originals.

Second, constant price estimates of capital stock have been replaced with chain volume measures.

Third, ownership transfer costs (formerly called 'real estate transfer expenses') are now completely depreciated within a year, thus effectively eliminating them from the capital stock. The ABS has taken the view that as they have no resale value they should not be recorded in the capital stock of the national balance sheet.

OTHER IMPROVEMENTS TO CAPITAL STOCK ESTIMATES

Asset Life Evaluation

There is little useful information available about the length of the economic lives of Australian assets. Some data are available for assets in other countries, but they are quite limited and one has to be careful in using them because they relate to different environments (economic, tax, physical, climatic, etc.).

However, some fairly recent data from New Zealand are of interest. In 1992, Statistics New Zealand (SNZ) was commissioned by the New Zealand Inland Revenue Department (NZIRD) to conduct a survey to determine mean depreciation rates, useful lives and residual values for a specified list of asset types for a selected group of industries. The primary purpose of the survey was to provide the NZIRD with information to help it revise categories of assets in its depreciation schedule and prescribe their tax depreciation rates. SNZ also intended to use the information with the PIM to derive estimates of capital stock, but this has yet to be done.

The estimated useful asset lives from the New Zealand survey were compared with those used in the ABS's PIM and it was found that, in aggregate, the survey lives are similar to the lives used by the ABS.

Also relevant, however, are the experiences of the few national statistical agencies that have undertaken direct collections of capital stock data, most notably the Netherlands Central Bureau of Statistics (NCBS). The NCBS has found that the PIM can give significantly different estimates from those obtained by direct collection, even when using mean asset lives determined from direct collections undertaken quite recently. Both the NCBS and the United Kingdom Office for National Statistics (UKONS) are moving in the direction of undertaking periodic direct collections to provide benchmarks for annual PIM estimates.

Asset Lives - Allowing for compositional change

In the past, the ABS applied the PIM at quite an aggregate level. In the case of equipment, the PIM was applied on total equipment for each industry by sector, and no allowance was made for the changing composition of equipment within these aggregates, other than the assumption of a

5% per decade decline in mean asset lives for equipment in aggregate. There is, however, evidence of compositional change leading to a shortening in the mean asset lives of aggregates. For example, the proportion of private capital expenditure on computer equipment has risen over the last 50 years from zero to about 12%, and computer equipment has a lower mean asset life than the rest of equipment. Within computer equipment there has been a compositional change from mainframes to PCs, and PCs have shorter lives than mainframes.

To address this problem, the capital stock system has been redeveloped to apply the PIM at a more detailed level for equipment. For each industry/sector capital stock estimates are now derived for each of the following six broad equipment asset types:

- road vehicles;
- other transport equipment;
- industrial machinery and equipment;
- computers and computer peripherals;
- electronic and electrical machinery and communications equipment, and
- other plant and equipment.

Due to a lack of information as to whether asset lives have been lengthening or shortening, the asset lives of all categories other than road vehicles and computers have been held constant. In the case of road vehicles, motor vehicle registration data imply that asset lives have been lengthening and this has been taken into account in estimating capital stock.

Estimates of capital expenditure on equipment for each of the industry/sector/asset type categories are derived by breaking down the use-side total capital expenditure on equipment using quarterly supply-side data in conjunction with infrequent annual use-side benchmarks in an input-output framework. The supply-side data comprise import commodity data plus quarterly manufacturers' sales by industry which have been allocated to the six equipment categories using less frequently obtained manufacturing industry by commodity data. It is judged impracticable to use the supply-use approach to derive time series of capital expenditure on equipment estimates at a more detailed level than the six asset types shown above because of the difficulty and cost of getting accurate, detailed use data sufficiently frequently.

Rate of depreciation and age efficiency

It had been assumed in the past that assets depreciate by the same amount each year until the end of their lives. The approach used now is quite different: an age-efficiency function is specified (which describes the decline in the real productive value of the asset) and this is used to determine the rate of decline in the economic value of the asset and hence the rate of depreciation. By adopting this approach consistency is achieved between the estimates of productive and economic capital stock.

Unfortunately, there is a lack of empirical data about the shape of age-efficiency functions, and the choice is a matter of judgement.

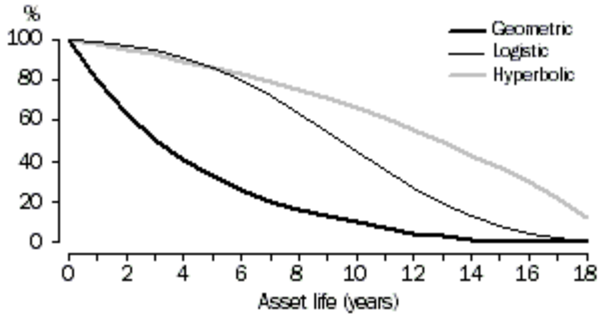
Some productivity analysts, most notably Dale Jorgenson (a leader in the development of MFP estimation), have used geometric functions, i.e. the efficiency of the asset declines by the same percentage from one year to the next. This implies that the efficiency of an asset falls by smaller amounts in absolute terms as it ages.

The US Bureau of Labor Statistics (BLS) uses hyperbolic functions, i.e. the efficiency of the asset declines by small amounts at first and the rate of decline increases as it ages.

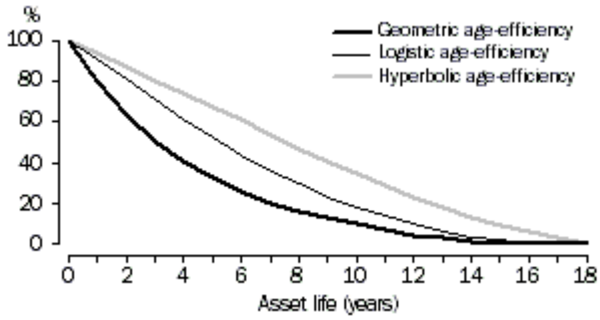
Paul Gretton and Bronwyn Fisher in their paper **Productivity Growth and Australian Manufacturing Industry** (Industry Commission, 1997) use logistic functions, i.e. initially the rate of decline is similar to the hyperbolic function until a point of inflection is reached after which the rate of decline is similar to that observed with the geometric function.

The graphs below show (1) the main types of age-efficiency functions and (2) the age-price functions relating to each of the age-efficiency functions.

1. AGE-EFFICIENCY FUNCTIONS



2. AGE-PRICE FUNCTIONS



Hyperbolic decline - at least initially - seems more plausible than geometric decline for most asset types, and the ABS has adopted it for the time being. It has the form

$$E_t = (M - A_t) / (M - bA_t)$$

where

- E_t is the efficiency of the asset at time t (as a ratio of the assets' efficiency when new)
- M is the asset life as per the Winfrey distribution
- A_t is the age of the asset at time t
- b is the efficiency reduction parameter

b is set to 0.5 for equipment and 0.75 for structures - the same parameter values as used by the BLS.

It turns out that when the hyperbolic functions for each of the possible lives of an asset are weighted together (as per the Winfrey distribution), the resulting average age-efficiency function resembles a logistic function with a point of inflection towards the end of its maximum life. The BLS, and Gretton and Fisher assume that all the assets of a certain type and vintage die at the

same time (commonly referred to as simultaneous exit), so they just specify a hyperbolic or logistic function for the mean asset life.

COMBINING PRIVATE AND PUBLIC ENTERPRISE SECTORS

In the past, the ABS has compiled estimates of capital stock and consumption of fixed capital (depreciation) estimates separately for private enterprises and public enterprises. Given the recent extent of privatisations and the difficulties in dealing with them statistically, the estimates no longer distinguish between public and private enterprises.

FUTURE DEVELOPMENTS

The major shortcomings of any capital stock estimates are the assumptions on which they rest. The major assumptions are those relating to the mean asset lives and the age-efficiency functions. The only way to address these shortcomings is to collect the relevant data. The ABS intends to begin a feasibility study into the collection of capital stock related data in 1999-2000.

Another shortcoming concerns the treatment of purchases and sales of previously used assets. Essentially, the problem is that, at present, purchases of previously used assets are not distinguished in the PIM from purchases of new assets. The ABS plans to undertake further work on this problem, and remedy it as much as possible.

MULTIFACTOR PRODUCTIVITY (MFP) STATISTICS

MFP statistics provide a measure of changes in the efficiency of production. MFP is the ratio of the measure of output to two or more factor inputs. MFP represents that part of the change in production that cannot be explained by changes in the measured inputs. In ABS MFP statistics, the inputs are capital and labour. The term ‘multifactor productivity’ is used in preference to ‘total factor productivity’, as not all changes in all inputs are taken into account.

There are a number of alternative approaches to measuring MFP, including the use of different production functions. The approach adopted by the ABS has been founded on neo-classical economic theory and based on a translog production function in conjunction with two assumptions: there are zero economies of scale and the marginal products of capital and labour are equal to their respective real market prices.

MFP estimates can be affected by variations in capacity utilisation associated with the business cycle. It is for this reason that MFP growth is generally analysed over periods between peaks in the business cycle.

In Australia’s MFP estimates, real gross product is used as the measure of output. Because of this, intermediate inputs are not considered as a factor input, as these inputs have already been subtracted from gross output to form gross product. To derive MFP estimates at the detailed industry level, it is generally considered better to use gross output net of that intermediate input from within the industry as the measure of real output. In this type of analysis, the factor inputs are extended to include intermediate inputs from outside the industry. While this logic could also be applied to the compilation of the ABS’s more broadly-based MFP estimates, in practice the distinction is only really important for deriving MFP estimates for individual industries, because at the broader level intermediate inputs from ‘outside’ are a much smaller percentage of total intermediate inputs.

PREVIOUS ABS ESTIMATES OF MFP

The MFP indexes were derived by dividing constant price estimates of gross product by a chain Tornqvist index of capital and labour inputs. Capital and labour shares of income were used as the weights to combine indexes of capital input and hours worked. MFP indexes were compiled for the market sector and the non-farm market sector. (The market sector excludes industries for which the output measures are derived using input measures and ownership of dwellings; the latter being excluded as there are no measured labour inputs.)

The index of capital input for the non-farm market sector was formed as a chain Tornqvist index of constant price estimates of the productive capital stock of equipment, non-dwelling construction and real estate transfer expenses and private non-farm inventories. For the market sector, the stock of agricultural land and the inventories of public marketing authorities and farms were also included. Estimates of rental prices (the capital analogue of wage rates) were used to derive weights to combine these different asset types. This weighting process was necessary to convert productive capital stock estimates to an index of capital services, which is the appropriate capital input measure for deriving the MFP index.

An index of hours worked was used to estimate labour input for the ABS's MFP statistics. This index made no allowance for changes in the quality of labour over time.

THE DEVELOPMENT OF NEW MFP ESTIMATES

The nature of the data and the methods used to derive the ABS's MFP estimates have undergone a major overhaul. The major changes are as follows:

- chain volume estimates are now used for measuring output and capital input;
- the capital inputs of fixed tangible assets (i.e. equipment and structures) are now derived from the improved estimates of productive capital stock, described above;
- the scope of capital inputs has been changed to include the capital services of livestock, intangibles and non-agricultural land and to exclude ownership transfer costs;
- the productive capital stock estimates are now combined using rental prices at a much finer level of detail: by industry by asset type (including the new six equipment categories); and
- the rental price formula now includes provision for the effect of taxes, various allowances and subsidies.

The inclusion of non-agricultural land is important because it grows at a slower rate than other capital inputs. Its exclusion in the past has led to the MFP growth rates being biased downwards. Weighting the capital inputs together (using rental prices) at a more detailed level takes better account of the effect of changes in the composition of assets on growth rates of capital services, and it can make a significant difference to the growth rates of total capital input.

Apart from the inclusion of a provision for the effect of taxes, allowances and subsidies, the rental price formula is generally unchanged from that previously used. The exception is the formula used to calculate rental prices for computers, computer peripherals and computer software. The rental prices for these assets obtained using the old formula seemed implausibly high and a new formula, which produces significantly lower rental prices, has been used. This has had the effect of significantly dampening what would otherwise have been very strong growth rates in total capital services, particularly during the 1970s and 1980s.

The ABS intends to further investigate the issue of the most appropriate rental price formula to be used in its MFP estimates.

There has been no change to the derivation of the labour input services, or to the way in which labour and capital inputs are combined.

MFP estimates are now published for only the market sector and no longer for the non-farm market sector. MFP estimates for the non-farm market sector can be provided on request.

FUTURE DEVELOPMENTS

Apart from further improvements to the underlying capital stock data, the next major improvement to the market sector estimates concerns refining the measure of labour input. The existing measure of labour input is hours worked, which takes no account of changes in the quality of labour, and so there is an asymmetry between capital and labour inputs. The existing MFP growth rates could be biased upwards if labour quality is rising or biased downwards if labour quality is falling. The ABS intends to investigate the development of a quality-adjusted labour input series as resources permit.

Another likely development is improved output measures (i.e. output measures that are derived independently of inputs) for certain industries that are currently considered non-market. The ABS has undertaken extensive work in a number of areas, including health, and it is expected that the results of this work will start to appear in the national accounts sometime during 1999-2000. Consideration will then be given to extending the MFP estimates to cover these areas.

It is not proposed to extend the calculation of MFP estimates to individual industries in the near future. It is important to have consistent and comprehensive time series of reasonable quality (including real measures of intermediate input) to make it worthwhile. Eventually, the supply-use tables in current prices and in the prices of the previous year (which are now used to benchmark the quarterly national income, expenditure and product accounts) and the output from further work on labour statistics will provide much of the necessary data.

IMPACT ON GROWTH RATES OF CAPITAL STOCK AND PRODUCTIVITY

As a result of the changes described earlier in this article the growth rates for items of capital stock, consumption of fixed capital, capital services and productivity have been revised. A brief summary of the changes is provided below.

Net Capital Stock - All Sectors

The average annual growth rate of net capital stock in chain volume terms between 30 June 1985 and 30 June 1996 was 2.9%; this compares with the 2.6% average annual growth in constant price terms as previously published. (Between 30 June 1985 and 30 June 1998, the revised average annual growth rate in chain volume terms was also 2.9%.) The upward revision is mainly due to the inclusion of new asset types and the switch to chain volume measures.

The main assets contributing to the higher growth rate were computer software and other buildings and structures, which was expanded to include certain capitalised services. With an average annual growth rate of 24%, computer software is by far the fastest growing asset, but it represents only 1% of total net capital stock. On a sectoral basis, the main contributions to growth came from non-financial corporations and households; financial corporations and general government made only minor contributions. The industries showing strongest growth in net

capital stock over this period were ownership of dwellings, mining and property and business services.

Consumption of Fixed Capital - All Sectors

The average annual growth rate of consumption of fixed capital in current price terms between 1984-85 and 1995-96 has been revised upwards significantly, from 7.1% to 8.1%. (Between 1984-85 and 1997-98, the revised average annual growth rate was 7.5%.) The upward revision is mainly due to the inclusion of computer software, which contributed an extra 0.6 percentage points to the growth rate. Computer software is depreciated more rapidly than most assets, so it contributes more heavily to consumption of fixed capital than to capital stock.

The main assets contributing to the growth rate were machinery and equipment, other buildings and structures and dwellings. On a sectoral basis, the main contributions to growth came from non-financial corporations and households. The strongest growing industries over this period were ownership of dwellings, manufacturing and property and business services.

Capital Services - Market Sector

The long-term average annual growth rate of capital services (between 1964-65 and 1995-96) has been revised upwards from 3.2%, as previously published, to 4.4%. Higher growth rates have occurred throughout the full length of the series but are more noticeable in the early periods, especially between 1964-65 and 1973-74. The increase in the growth rate of capital services reflects the increased growth rates of net capital stocks and consumption of fixed capital

Productivity - Market Sector

The long-term average annual growth rate of gross product is largely unchanged, so the upward revision to growth for capital services has made a marked difference to the growth of capital productivity. The previous average annual growth rate of -0.1% over the period 1964-65 to 1995-96 has been revised downwards to -1.1%.

In 1996-97, capital productivity increased by 1.1%. In 1997-98, it fell by 0.4%.

The labour input series - hours worked - has not been revised. Consequently the estimates of labour productivity have remained essentially unchanged from those previously published. In 1997-98, labour productivity increased by 4.5%, following an increase of 3.8% in 1996-97.

The downward revisions to capital productivity growth rates have caused multifactor productivity growth to also be revised downward. Average annual growth over the long term has only been reduced marginally, from 1.5% to 1.3% - but in the early growth cycles the reduction has been more substantial.

In both 1996-97 and 1997-98 multifactor productivity grew by 2.9%. Over the most recent MFP growth cycle (1993-94 to 1997-98), multifactor productivity has grown annually, on average, by 2.4%.

FURTHER INFORMATION

Copies of **Australian System of National Accounts 1997-98** (ABS Cat. no. 5204.0), which includes the upgraded capital stock and multifactor productivity estimates, are available from the ABS bookshop in your state or territory (RRP $32.00) (Credit card orders Ph: 1800 815 397).

APPENDIX
TABLE A1. INDEXES OF PRODUCTIVITY AND RELATED MEASURES (a) Market Sector (b)

	Productivity			Output	Input			
Period	Labour (c)	Capital (d)(g)	Multifactor (e)(g)	Gross product (f)	Hours worked	Capital services (g)	Total labour and capital (g)	Capital - labour ratio (g)
1964-65	48.6	140.9	65.4	35.5	73	25.2	54.3	34.5
1965-66	47.3	131.9	62.9	35.8	75.7	27.1	56.8	35.8
1966-67	48.2	131	63.7	37.9	78.7	29	59.6	36.8
1967-68	48.8	126	63.6	39	79.8	30.9	61.2	38.7
1968-69	53.7	130.8	68.9	43.4	80.7	33.2	62.9	41.1
1969-70	54.7	127.8	69.4	45.4	82.9	35.5	65.4	42.8
1970-71	55.7	124	69.7	47.5	85.3	38.3	68.3	45
1971-72	57.6	121.9	71	49.6	86.1	40.7	69.8	47.2
1972-73	58.8	120.2	71.8	50.8	86.4	42.3	70.8	49
1973-74	62.1	121.4	74.7	54.3	87.5	44.7	72.6	51.1
1974-75	63.8	116.2	75.4	54.4	85.1	46.8	72.1	54.9
1975-76	65.3	113.3	76.2	54.6	83.6	48.2	71.6	57.6
1976-77	68.4	114.5	79.1	56.8	83.1	49.6	71.8	59.7
1977-78	68.9	111.2	79	56.7	82.4	51	71.9	61.9
1978-79	71.7	112.2	81.6	59.3	82.7	52.9	72.8	64
1979-80	72.1	110.2	81.5	60.4	83.8	54.8	74.1	65.4
1980-81	72.4	107.2	81.1	62	85.6	57.8	76.4	67.5
1981-82	75	104.6	82.7	64.2	85.6	61.4	77.6	71.7
1982-83	73.4	94.9	79.5	60.3	82.1	63.6	75.9	77.4
1983-84	77.2	96.6	82.8	63.5	82.3	65.7	76.7	79.9
1984-85	80.3	99.1	85.8	67.7	84.3	68.4	78.9	81.1
1985-86	80.8	98.3	86	69.7	86.3	71	81.1	82.3
1986-87	79.3	96.3	84.4	70.5	88.9	73.2	83.6	82.3
1987-88	81.5	99.2	86.8	75.3	92.3	75.9	86.7	82.2
1988-89	83.5	100.3	88.5	80.1	95.8	79.8	90.4	83.3
1989-90	83.4	98.8	88	82.8	99.3	83.8	94	84.4
1990-91	85	95.7	88.3	82	96.5	85.7	92.9	88.8
1991-92	87.5	93.2	89.3	81	92.6	87	90.7	93.9
1992-93	89.7	94.4	91.3	83.6	93.2	88.6	91.7	95
1993-94	92.3	96.6	93.7	87.7	95	90.8	93.6	95.6
1994-95	92.6	97.3	94.2	91.5	98.7	94	97.1	95.2
1995-96	96.3	98.9	97.1	95.7	99.4	96.8	98.6	97.4
1996-97	100	100	100	100	100	100	100	100
1997-98	104.5	99.6	102.9	104.8	100.3	105.2	101.9	104.9
Compound annual percentage change between MFP growth-cycle peaks								
1964-65 to 1968-69	2.5	-1.9	1.3	5.1	2.5	7.1	3.8	4.5
1968-69 to 1973-74	2.9	-1.5	1.6	4.6	1.6	6.2	2.9	4.5
1973-74 to 1981-82	2.4	-1.8	1.3	2.1	-0.3	4	0.8	4.3
1981-82 to 1984-85	2.3	-1.8	1.2	1.8	-0.5	3.7	0.6	4.2
1984-85 to 1988-89	1	0.3	0.8	4.3	3.3	3.9	3.5	0.7
1988-89 to 1993-94	2	-0.8	1.1	1.8	-0.2	2.6	0.7	2.8
1993-94 to 1997-98	3.1	0.8	2.4	4.6	1.4	3.8	2.2	2.4
1964-65 to 1997-98	2.3	-1.0	1.4	3.3	1	4.4	1.9	3.4

(a) Reference year for indexes is 1996-97=100.0
(b) The 'market sector' refers to ANZSIC divisions A to K and P.
(c) Gross product per hour worked.
(d) Gross product per unit of capital services.
(e) Gross product per combined unit of labour and capital.
(f) Chain volume measure. Reference year is 1996-97.
(g) Experimental.

Source: **Australian System of National Accounts, 1997-98** (ABS Cat. no. 5204.0), table 1.17, page 38.

TABLE A1. CAPITAL STOCK (a)

	At current prices			Chain volume measures (b)			
Period	Gross fixed capital formation $m	End-year net capital stock $m	Consumption of fixed capital $m	Gross fixed capital formation $m	End-year net capital stock $m	Consumption of fixed capital $m	End-year average age of gross stock years
1984-85	55 315	656 047	34 356	78 468	1 009 112	49 295	14.8
1985-86	63 739	738 660	39 544	82 481	1 046 195	51 566	14.9
1986-87	69 109	814 459	45 173	82 545	1 080 365	53 995	15
1987-88	79 056	899 993	51 082	89 380	1 118 159	57 561	15.1
1988-89	92 915	1 005 190	57 520	99 165	1 162 564	61 329	15.2
1989-90	97 917	1 097 359	61 037	99 713	1 205 923	62 633	15.3
1990-91	88 992	1 147 697	64 301	89 920	1 234 088	65 818	15.4
1991-92	84 846	1 177 347	67 094	85 898	1 245 423	68 494	15.7
1992-93	92 043	1 212 973	70 624	91 523	1 278 077	70 683	15.9
1993-94	98 941	1 256 430	74 554	97 276	1 304 985	73 629	16.1
1994-95	110 652	1 316 508	76 946	109 010	1 341 683	76 206	16.2
1995-96	112 799	1 364 933	80 611	110 030	1 376 018	78 717	16.3
1996-97	120 891	1 417 338	82 372	120 891	1 417 338	82 372	16.3
1997-98	131 930	1 487 076	88 016	130 931	1 463 324	87 090	16.4

(a) Estimates of capital stock by type of asset, institutional sector and industry are published in Australian System of National Accounts, 1997-98(ABS Cat. no. 5204.0).
(b) Reference period for chain volume measures is 1996-97.
Source: **Australian System of National Accounts, 1997-98**(ABS Cat. no. 5204.0), table 4.8 (last wafer), page 87.

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